

## SUPER ABUNDANT FEMALE FLOWER-PRODUCTION IN A COCONUT

*Bunga betina yang lebat sekali pada sebatang pohon kelapa.*

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### ABSTRACT

A rare coconut palm, located in July 1977 at village Idi of Aceh Province (Indonesia), produced about one thousand mature fruits in 1978. Over ten thousand buttons and young nuts were seen in the crown during early 1979. But the setting percentage is as low as 0 - 20 between spadices. This super elite palm, resembling a hybrid between tall and dwarf varieties, produces in some spadices a fantastic one thousand female flowers or more each. Fruits are small-sized, and many seedlings of this palm have been obtained and planted at the Industrial Crops Research Institute's seed garden at Payagajah, Aceh Province. The performance of the seedlings as well as the mother palm are being studied.

### RINGKASAN

Sebatang pohon kelapa yang aneh, tumbuh di kampung Idi, Propinsi Aceh, dijumpai dalam bulan Juli 1977. Pohon ini menghasilkan kira-kira seribu buah kelapa yang tua dalam tahun 1978. Lebih dari sepuluh ribu putik dan buah muda terlihat pada tajuk selama permulaan tahun 1979. Akan tetapi yang dapat menjadi buah hanya sekitar 0 - 20 persen antara malai (spadik). Pohon kelapa yang sangat hebat ini mirip dengan suatu hibrida antara varietas dalam dengan varietas genjah, menghasilkan pada beberapa malai (spadik) sejumlah seribu atau lebih bunga betina yang mengagumkan. Buahnya berukuran kecil-kecil dan telah diperoleh bibit (kitri) yang banyak dari pohon kelapa ini dan telah pula ditanam di kebun Induk LPTI Payagajah, Propinsi Aceh.

"Performance" dari bibit serta pohon induknya dewasa ini sedang diteliti.

### INTRODUCTION

In coconut, the number of female flowers (more so, the male flowers) per spadix varies considerably with variety/form, age of tree, season and the conditions in which they are grown, not ignoring the

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genetic make-up of the individuals. Also great variation are met with in the production of female flowers between palms of the same variety/form and between spadices of the same tree. Patel (1938), who made elaborate studies on the subject, mentioned that the production of female flowers differs among trees as well as among the inflorescences of the same tree, and that the variation among trees of the same age and receiving the same treatment is genetical. According to Jack and Sands (1929), the average number of female flowers per spadix varies between the colour types, green bearing 21.4 flowers, yellow 13.6 and red 10.6 female flowers. From the production records of 150 young palms comprising good, medium and poor bearers. Patel observed that the good palms produced between 100 and 300 flowers (one producing up to 400 flowers), while the medium bearers produced an average of 120 flowers, and the poor, only 41 female flowers. The average female flowers produced per palm/year in an older stand for the three groups according to Patel were 396, 264 and 156. Assuming that the good palms produced only 12 spadices in the year, the mean number of female flowers per spadix does not exceed 33. During the summer months of March to May, production of female flowers is very high. Marechal (1928) reported that in Fiji, the dwarf palms produce more female flowers during November to March compared to that of the rest of the year. More recently, production of much higher numbers of female flowers per spadix/palm have been recorded by investigators from India and elsewhere. Another striking case from Indonesia is reported here. Coconut breeders do not seem to attach much significance to the number of male flowers per spadix.

#### RECORD PRODUCTION OF FEMALE FLOWERS

The variety *spicata* recorded by Jacob (1941), produces a large number of female flowers on the unbranched spadix with a conspicuous reduction in the number of female flowers. One of the spadices of a *spicata* palm growing near village Pandu, North Sulawesi Province, Indonesia bore 205 female flowers. Davis (1953) published a photograph of a massive coconut spadix (Tall variety) bearing 416 female flowers. Recently, Ghosh (1978) recorded another spadix of a tall coconut palm from West Bengal (India) having 331 young fruits. At the Industrial Crops Research Institute, Bogor, we have among other collections, a coconut spadix from Lampung (South Sumatra) bearing 352 female

flowers. The tall Indian form, Laccadive micro according to Menon and Pandalai (1960) produces, on an average, 160 nuts per tree per year. Some of the spadices of this variety produce as many as one hundred female flowers each during favourable summer months. The size of nuts of this variety is very small which yields only 80 - 95 gm. of copra. Similar to the Laccadive micro, there is another palm which is recently described as a new variety, *Ayiramkachi*, by Ramachandran *et al* (1977) which produces an enormous number of female flowers, most of which do not develop into fruits. The palm is supposed to produce one thousand fruits (per year) as its Tamil name (*Ayiramkachi*) suggests. In this variety, only a few fruits develop to maturity eventhough the rest of them also persist on the spadix as sterile fruitlets. We describe here a highly prolific palm which looks like a hybrid between the tall and dwarf varieties and which produces over one thousand female flowers each in some of the spadices. This palm was located by one of us (Davis) at village Idi, Aceh Province (Indonesia). As is clear from Fig. 1 many of the fruits develop into medium-sized nuts, over one thousand ripe nuts having been harvested during 1978. Some of them were raised into seedlings, 34 of which having been purchased and planted at the LPTI Coconut Seed Garden at Payagajah, Aceh Province for further study.

#### ADDITIONAL INFORMATION ON THE IDI ELITE PALM

The palm under reference, just six years old in 1979, grows close to the residence of the owner, B.H. Ibrahim at village Idi in Sumatra. As reported by Ibrahim, he got it as a seedling from a good bearing tall variety palm from a small holding owned by Inom Brahim, some 11 km distant from Idi and planted it in January 1973 at the age of approximately seven months from sprouting. The seedling was not given any extra fertilizers, but because of its proximity to the residence, the soil is quite fertile. Growth of the seedling was said to be very fast, an indication that the seedling could be a natural hybrid between the tall mother and a dwarf pollen parent. The general appearance, the form and size of the crown and fruits further suggest the palm to be a hybrid. In some bunches, the male and female blooming phases overlap in addition to clear overlapping of phases between spadices. The palm bore 39 leaves in March, 1979.

*Flowering data* : The palm which has a right-handed foliar spiral, started flowering from the end of 1976, that is, in less than four years from planting. It produced 20 spadices until December 1977, within a period of about 13 months. The condition of the palm crown when first observed and photographed in July 1977 is shown in Fig. 1. There were many bunches of half matured nuts to just-opened spadix (not visible in picture) as well as still younger unopened inflorescences. But there was no emergence of new spadices for about ten months from December 1977 and the already formed nuts were ripening in the



Figure 1. The crown of the elite palm at Idi, Aceh Province (Indonesia) showing several bunches of fruits at different stages of development. Photo taken in July 1977.

Gambar 1. Mahkota tanaman kelapa yang istimewa di Idi, propinsi Aceh (Indonesia) memperlihatkan tandan buah yang banyak sekali pada berbagai tahap perkembangannya. Potret ini dibuat bulan Juli 1977.

meanwhile. The palm was again critically observed towards the end of March 1979 when the photograph in Fig. 2 was taken. Thus, the



Figure 2. Crown of palm in Fig. 3 photographed in March 1979. The spadix at top left bears a little over one thousand female flowers.

*Gambar 2. Mahkota tanaman kelapa yang disajikan dalam Gb. 3 dipotret bulan Maret 1979. Spadix disebelah kanan atas bunga betinanya berjumlah sedikit lebih dari seribu buah.*

palm clearly demonstrated alternate bearing. Bunches are produced at short intervals, approximately two per month even though leaf production is not as fast. Such a phenomenon is characteristic of palms having staggered flowering. The first bunch formed during the second fruiting cycle is very small compared to the rest and bears only 17 large nuts. There were 11 opened spadices, 2 large unopened ones and a few smaller ones. By the end of July 1979 there were already 19 opened spadices. The much heavier spadices bear over one thousand young fruits each. The female flowers of the youngest bunch visible in Fig. 2 (top left) were counted without causing serious injury to the spikes. Each spike bears 8 to 25 female flowers, producing on an average 17 flowers per spike. There are 60 spikes in this spadix which account for just over one thousand female flowers. It was almost impossible to count the buttons in the older bunches without damaging them. The spadix on the right top carries about one thousand small buttons. In October 1979, seven bunches that buckled due to drought were harvested and

the number of fruits and scars left by female flowers were counted. The data are presented in Table 1.

Table 1. Number of female flowers per spadix of the Idi coconut  
Tabel 1. Jumlah bunga betina per malai pada kelapa Idi

| Bunch ( <i>tandan</i> ) No. | No. of spikes<br><i>Jumlah spike</i> | No. of female flowers<br><i>Jumlah bunga betina</i> |
|-----------------------------|--------------------------------------|---|
| 1                           | 58                                   | 945   |
| 2                           | 63                                   | 971   |
| 3                           | 56                                   | 961   |
| 4                           | 55                                   | 1159  |
| 5                           | 51                                   | 919   |
| 6                           | 56                                   | 828   |
| 7                           | 60                                   | 1020  |

Data on the number of female flowers developed on the remaining spadices can be gathered when the ripe bunches are harvested. The scars left by the female flowers can be unmistakably recognized from even a dry spadix. In spadices like those of the *spicata* palm or similar heavy bearers, twin female flowers are often noticed as the ones reported by Ghosh (1978). By examining the prophylls (epicalyx) which stick to the spike even after the shedding of flowers, it will be possible to correctly account for the twin female flowers in order to estimate the total number of flowers.

*Fruits and seedlings* : All the 20 spadices of the first productive phase produced many medium to small-sized fruits. Ripe bunches were harvested at three-monthly interval, each bunch having 25 - 75 fruits. In all, a little over one thousand fruits were harvested including those that turned barren at a late stage. The frequency of barren nuts was reported to differ from bunch to bunch varying between 3 to 30 percent. The owner, after consuming most of the fruits at a tender stage, planted 105 fruits in a nursery 10 km from Idi. Of the 80 seedling that registered good growth, 43 were sold out or planted in his garden. At the time of our visit, only 37 seedlings were left, and a view of the nursery is shown in Fig. 3. They appear more like seedlings of a dwarf palm. Only 34 seedlings could be purchased at Rp. 250 each (1 US \$ = Rp. 625). An ordinary seedling costs about Rp. 100. The seedlings are planted at the Coconut Seed Garden at Payagajah, near Idi. Of them 23 were light green, similar to the mother palm, 7 dark green and the remaining 8 were light brown.



Figure 3. Seedling of the Idi coconut in nurse. The owner of the palm and nurse, B.H. Ibrahim is squatting donned with a helmet.

Gambar 3. Kitri kelapa Idi di persemaian. Pemilik kelapa dan persemaian ini ialah, B.H. Ibrahim yang berjongkok pakai topi.

These seven-month old seedlings produced, on an average, 4.2 laminate leaves which rate of production is more or less comparable to that of any normal seedling of tall variety. So also the total height and girth of collar of these Idi seedlings were similar to those of other seedlings. However, corresponding data on seedlings of other varieties/forms were not available for comparison as it was not possible to obtain seedlings of similar age. The girth of nuts was compared with those of Nias dwarf and Bali tall.

Mean height of 7-month old seedlings of Idi palm — 89.03 cm

Mean girth of shoot near nut — 8.45 cm

Girth of ripe nuts placed in nursery :

(a) Nuts of palm from Idi — 33.30 cm

(b) Nias yellow dwarf — 44.40 cm

(c) Bali tall nuts — 61.30 cm

Thus, the Idi nuts are about two-thirds the size of Nias dwarf nuts (maximum girth of whole fruits), but only about half the size of Bali tall nuts. Unfortunately, data on the weights and volumes of nut components of Idi palm could not be gathered during the first fruiting phase. But it is hoped that by early 1980, all possible data on nut compo-

nents, numbers of female flowers per bunch, good and barren nuts harvested, as well as details on the performance of the mother palm and the seedlings that flourish at the Payagajah Seed Garden could be gathered and reported.

In spite of the reduced size of fruits, the seedlings look vigorous and compare well with Nias dwarf seedlings.

Morphological data were obtained on the Idi seedlings as well as on 20 Bali tall seedlings. The data are presented in Table 2.

In March 1979, because of a fairly long drought, many leaves of the mother palm were found drooping. Some buttons have already shed and it is feared that most of the remaining would also be shed prematurely because of the dry spell. To reduce such a disaster, artificial irrigation has been initiated. In spite of this, seven bunches have buckled which were chopped off and the data on female flowers recorded in Table 1.

#### SIGNIFICANCE OF THE ELITE PALM

Iyer, Rao and Govindankutty (1979) of the Central Plantation Crops Research Institute, Kasaragod (India) published data on 9 of the 19 outstanding elite coconut palms located in Kerala that yield annually 200 to 300 fruits per palm, one of them giving as many as 471 fruits. Eventhough the copra yield of these nuts is not known, these figures are significant since the West Coast of India tall palms produce, on an average, only 60 fruits under rainfed conditions, which figure could be pushed to a maximum of 110 nuts with good management and by providing irrigation. The best tall x dwarf hybrids, according to the above authors, yielded 174 nuts per palm/year. Moreover, 13 of the 19 elite palms were located within an area ravaged by a serious disease of unknown aetiology. Some of them could prove to be resistant to this Root Wilt disease. No breakthrough in the improvement of coconut production could be achieved through breeding because of the many constraints inherent in this perennial crops. Hence, other areas are being exploited : one being the collection, conservation, evaluation and utilization of the promising palms. When one or more elite palms are identified and tested, hopefully they can be multiplied clonally, there by circumventing the tedious breeding methods of crop improvement. Scientists of many countries are actively investigating to achieve vegetative propagation in the coconut. Within the next ten years, coconut workers will have achieved this on a par with the success with the soil palm.

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Table 2. Data on seedlings of rare coconut at Idi (October 1979)

Tabel 2. Data dari kitri kelapa istimewa di Idi (Oktober 1979).

| Seedling         | Number of green leaves | Girth at collar<br>(cm)                 | Height from top<br>of nut (cm)       |
|------------------|------------------------|---|--------------------------------------|
| Kitri            | Jumlah daun hijau      | Keliling batang<br>pada pangkalnya (cm) | Tinggi tanaman<br>sampai puncak (cm) |
| 1                | 7                      | 16.5                                    | 124.0                                |
| 2                | 6                      | 13.5                                    | 97.0                                 |
| 3                | 8                      | 22.5                                    | 183.0                                |
| 4                | 8                      | 20.5                                    | 166.0                                |
| 5                | 7                      | 16.5                                    | 126.0                                |
| 6                | 7                      | 19.5                                    | 149.0                                |
| 7                | 7                      | 19.5                                    | 128.0                                |
| 8                | Dead                   | —                                       | —                                    |
| 9                | 8                      | 22.5                                    | 161.0                                |
| 10               | 5                      | 12.5                                    | 98.0                                 |
| 11               | 6                      | 15.5                                    | 131.0                                |
| 12               | 9                      | 22.0                                    | 127.0                                |
| 13               | 8                      | 21.5                                    | 158.0                                |
| 14               | 9                      | 19.0                                    | 140.0                                |
| 15               | 9                      | 18.0                                    | 149.0                                |
| 16               | 8                      | 19.5                                    | 136.0                                |
| 17               | 9                      | 17.5                                    | 135.0                                |
| 18               | 9                      | 18.5                                    | 151.0                                |
| 19               | Dead                   | —                                       | —                                    |
| 20               | 9                      | 20.0                                    | 160.0                                |
| 21               | 9                      | 21.5                                    | 140.0                                |
| 22               | 10                     | 18.0                                    | 150.0                                |
| 23               | 7                      | 7.0                                     | 60.0 (dying)                         |
| 24               | 9                      | 12.5                                    | 95.0                                 |
| 25               | 9                      | 18.0                                    | 128.0                                |
| 26               | 9                      | 18.5                                    | 150.0                                |
| 27               | 10                     | 23.5                                    | 161.0                                |
| 28               | 11                     | 16.0                                    | 118.0                                |
| 29               | 10                     | 18.0                                    | 138.0                                |
| 30               | 9                      | 20.0                                    | 141.0                                |
| 31               | 9                      | 21.0                                    | 133.0                                |
| 32               | 9                      | 18.5                                    | 126.0                                |
| 33               | Dead                   | —                                       | —                                    |
| 34               | Dead                   | —                                       | —                                    |
| Total            | 250                    | 547.5                                   | 4059.0                               |
| Mean (Rata-rata) | 8.3                    | 18.25                                   | 135.3                                |
| Bali Tall (mean) | 8.6                    | 21.30                                   | 168.3                                |

The Idi seedlings are slightly smaller than the Bali tall seedlings.

*Survey for coconut germplasm* : A search for high yielding elite palms and others with additional desirable characters such as resistance to diseases, pest, drought and water-logging, short stem is already in progress. At the International Symposium on Coconut Research and Development held at Kasaragod in 1976, the Director-General of Indian Council of Agricultural Research (Dr. M.S. Swaminathan) more than emphasized the need for surveying coconut areas for locating promising individuals. This has resulted in the identification of at least 19 elite palms in India. In many countries, there are established organization that deal with plant and animal genetic resources. Coconut is receiving its due share in this regard as there are national committees in all the major coconut growing countries to help coconut germplasm collection. Recently, the International Board for Plant Genetic Resources organized a meeting at the FAO headquarters at Rome and produced the useful document, "Coconut Genetic Resources (1978)" which is an unified guideline for those who engage themselves in coconut germplasm surveys.

*Indonesia with its unlimited potential* : The work of coconut germplasm survey has been active in Indonesia for many years. The Industrial Crops Research Institute has identified many coconut forms/cultivars most of which having great promise in improving coconut yields. The very popular Malayan dwarf is said to have originated from this country. Another dwarf form (Nias yellow dwarf) and three tall forms (Bali, Palu and Tenga) are being used in the production of dwarf x tall and tall x tall hybrids on a massive scale. There are a few other varieties/forms which are yet to be exploited for commercial purpose, as for example, the tall form, Takome of North Maluku which yields over 150 medium-sized nuts per year. Kelapa Raja, Kelapa Kopior, Kelapa Kenari and Kelapa Minyak that is stated to contain about 80% oil in relation to copra weight, are a few other regionally popular forms/cultivars. Other common forms which show morphological variation such as the *spicata*, *semi-spicata*, *androgena* and *macapuno* are also to be found in Indonesia. The island nature of the country, its location along the equator, the total isolation of some islands for many generations, the rich volcanic soil and above all, the evenly distributed heavy rainfall in most areas sustain rich and often unique vegetation, and coconut palm cannot have a more congenial land to thrive and to manifest its potential.

The elite coconut at Idi is just one of several individuals likely to be located in this country for trial and multiplication when found desi-

able. Both the seed and pollen from such palms could be used for breeding. The Idi palm, the Ayiramkachi, the Takome form and presumably some of the elite palms located in India are all hybrids between tall and dwarf varieties.

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